

## Each of Us Is a Society

By Joshua Lederberg

A HUMAN BEING is a society of living cells, organized in a hierarchy of interdependent tissues and organs.

They perform special roles in the economy of the whole organism and each cell shows many earmarks of its particular labors.

Thus a nerve cell may sprout a long cable-like axon to communicate impulses from the brain via the spinal cord to the extremities. A red blood cell will eventually shed its DNA; carrying oxygen by hemoglobin is too simple a function to require a constant flow of genetic information.

A cell in the testis will retain the capacity for rapid multiplication to assure a life-long supply of potential sperms to participate in propagation of the species. In the ovary, the eggs are preformed by the time of birth. They have the remarkable capacity to remain dormant for years before being reawakened by a hormonal stimulus to try the gamble of possible fertilization.

These specializations are powerful displays of the subordination of component tissues to the adaptive functioning of the whole organism. The unit of evolutionary change—that is, the quantum of reproduction and hereditary variation—is the intact organism. Just those variations will be preserved in the DNA of the whole organism that support its fitness, regardless of the self-immolation that the DNA may prescribe to some individual cells and tissues.

Because the whole organism has captured the reproductive process, total cells like those that make skin, hair and gut lining can be entrained in a perpetual cycle of growth and rapid death, while others like heart muscle and nerve may span the lifetime of the body.

### Science and Man

THE ANALOGY is sometimes used to justify a totalitarian organization of society. But evolution is amoral. The rigid hierarchy of somatic cells—the troops and citizenry of the working body—merely shows the consequences, not the ethical value, of an evolutionary process which already gives absolute priority to the competitive fitness of the whole organism with no regard whatever for any individual cell.

If tissue cells were more educable this would, of course, let them be more flexibly interchangeable in function, at the price of an even more complex governing machinery to allocate different cells to different tasks. Were the life challenges to a single organism any more complex than they already are, such a radical reconstruction of somatic cell relationships might be a necessary condition of survival.

In fact, this already occurs to a remarkable degree in the development of the brain. In this organ, it has been very difficult to find narrowly delimited functions predestined at birth. There are, of course, many exceptions, but human personalities have survived massive excisions of brain tissue. Other cells learn to take over the functions of the ones ablated. Man's highest organ therefore gives the least support to organicist politics.

WITHOUT INTELLIGENT intervention, none of the hundred million million cells could live independently of the body which they collectively comprise. Just 60 years ago, however, Dr. Ross G. Harrison at Yale University discovered that nerve cells could be taken out of the body and maintained alive in the test-tube.

The nutrients, warmth, shelter and control stimuli that the cell receives from its social intercourse within the body can be replaced in an artificial environment created by the investigator. In-

deed, he uses the responses of the isolated tissue cell to test his analyses of the composition of normal and abnormal body fluids.

This historic discovery was the focal point of a new era of experimental biology only just now reaching its maturity. It also represents a major fork in the evolution of earthly life, since each new culture lineage of tissue cells can be regarded as a potential new species of microbe.

These species are constrained to live in an artificial world of glass, synthetic chemicals and distilled water. But is modern man very different in his requirements?

Somatic cell biology also impinges on ethics by challenging the definability of "man." It is very difficult on purely scientific principles to demarcate a person from an aggregate of tissues that can be sustained separately in the laboratory.

Biology does not deny personality, but it refuses to give simple, absolute answers to questions of man's place in society.

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